

CLAIMS

1. A press forming method comprising the steps of:

providing a press machine comprising

a fixed plate,

a slide plate disposed to face the fixed plate and movable relatively to the fixed plate and

a plurality of drive sources each having a servo-motor for driving the slide plate and pressing each of a plurality of engaging portions positioned on the slide plate to press horizontally the slide plate, and

press-forming a work-piece at descending speeds of the plurality of drive sources in a trial forming,

the descending speeds being set to be sufficiently small and same among the plurality of drive sources at an initial stage of the trial forming and then adjusted so as to be close to target speeds of a production forming and so that a delay difference between a displacement of each of the plurality of drive sources and an instructed displacement is less than a predetermined value, by a delay adjustment step among the drive sources and a driving speed increasing step,

wherein, in the delay adjustment step, each of the descending speeds for the plurality of driving sources is adjusted by such a speed increment that the delay difference becomes less than or equal to the predetermined value, and,

in the driving speed increasing step, the descending speeds for the plurality of driving sources are adjusted to increase more than in the delay adjustment step and close to the target speeds of the production forming.

2. A press forming method comprising the steps of:

providing a press machine comprising

a fixed plate,

a slide plate disposed to face the fixed plate and movable relatively to the fixed plate and

a plurality of drive sources each having a servo-motor for driving the slide plate

and pressing each of a plurality of engaging portions positioned on the slide plate to press horizontally the slide plate, and

press-forming a work-piece at sufficiently small and same descending speeds among the plurality of drive sources in a trial forming,

measuring a displacement delay of each of the plurality of drive sources from an instructed displacement during the trial forming,

comparing a difference between a displacement delay (hereinafter referred to as “reference delay”) of a drive source (hereinafter referred to as “reference drive source”) among the plurality of drive sources from the instructed displacement and a displacement delay of each of other drive sources than the reference drive source from the instructed displacement with a predetermined value and comparing a descending speed of each of the plurality of drive sources during the trial forming with a target speed of the drive source for a production forming,

if the difference between the reference delay and the displacement delay of one of the other drive sources is more than the predetermined value, preparing a speed increment (hereinafter referred to as “compensation increment”) for the one of the other drive sources, corresponding to the difference between the reference delay and the displacement delay so as to eliminate the difference between the reference delay and the displacement delay for the one of the other drive sources to add the compensation increment to the descending speed of the trial forming for the one of the other drive sources,

if a difference between the descending speed of each of the plurality of drive sources during the trial forming and the target speed of the drive source for the production forming is more than a predetermined speed difference, preparing a speed increment so as to make the descending speed close to a target speed for the drive source to add the speed increment to the descending speed,

press-forming a work-piece at descending speeds adjusted with the compensation increment and/or the speed increment for a repeated trial forming,

measuring a displacement delay of each of the plurality of drive sources from an instructed displacement during the repeated trial forming,

comparing a difference between a reference delay of a reference drive source among the

plurality of drive sources and a displacement delay of each of other drive sources than the reference drive source from the instructed displacement with the predetermined value and comparing the adjusted descending speed with the target speed for the production forming, repeating the step of preparing the compensation increment and the steps following the step of preparing the compensation increment, until the difference between the reference delay and the displacement delay becomes less than or equal to the predetermined value and until the difference between the descending speed and the target speed becomes within the predetermined speed difference, and

if the difference between the reference delay and the displacement delay becomes less than or equal to the predetermined value and the difference between the descending speed and the target speed becomes within the predetermined speed difference, press-forming a work-piece at the descending speed for each of the plurality of drive sources in a production forming.

3. A press forming method as set forth in claim 2, wherein the reference drive source is a drive source having a minimum displacement delay from the instructed displacement at a displacement among the plurality of drive sources.

4. A press forming method as set forth in claim 2, wherein the predetermined value for comparing the difference between the reference delay and the displacement delay of each of the other drive sources is a first predetermined value, and

the method further comprises:

judging whether or not the difference between the reference delay and the displacement delay of each of the other drive sources is more than a second predetermined value that is less than the first predetermined value, if, in any of the steps of comparing the difference and the descending speed, the difference is less than or equal to the first predetermined value and a difference between a descending speed of a drive source in the trial forming and the target speed is within the predetermined speed difference,

if the difference between the reference delay and the displacement delay is more than the second predetermined value, preparing an additional compensation increment,

corresponding to the difference between the reference delay and the displacement delay, to add the additional compensation increment to the descending speed of the drive source, repeating the steps of judging and preparing, until the difference between the reference delay and the displacement delay becomes less than or equal to the second predetermined value, and

if the difference between the reference delay and the displacement delay becomes less than or equal to the second predetermined value, press-forming a work-piece in a production forming.

5. A press forming method as set forth in claim 3, wherein the predetermined value for comparing the difference between the reference delay and the displacement delay of each of the other drive sources is a first predetermined value, and

the method further comprises:

judging whether or not the difference between the reference delay and the displacement delay of each of the other drive sources is more than a second predetermined value that is less than the first predetermined value, if, in any of the steps of comparing the difference and the descending speed, the difference is less than or equal to the first predetermined value and a difference between a descending speed of a drive source in the trial forming and the target speed is within the predetermined speed difference,

if the difference between the reference delay and the displacement delay is more than the second predetermined value, preparing an additional compensation increment, corresponding to the difference between the reference delay and the displacement delay, to add the additional compensation increment to the descending speed of the drive source, repeating the steps of judging and preparing, until the difference between the reference delay and the displacement delay becomes less than or equal to the second predetermined value, and

if the difference between the reference delay and the displacement delay becomes less than or equal to the second predetermined value, press-forming a work-piece in a production forming.